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(54) Absorbant structure, and method of making same

Absorbierende Zusammensetzung und Verfahren zu ihrer Herstellung

Composé absorbant et procédé pour sa fabrication

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Description

FIELD OF THE INVENTION

[0001] This invention relates to liquid absorbent structures. In its more specific aspect, this invention relates to dry laid webs containing superabsorbent materials and stabilized with binder for use as liquid absorbent structures. Another aspect of the invention includes the method for making such structures.

BACKGROUND OF THE INVENTION AND PRIOR ART

[0002] Dry forming systems, and in particular air laying systems, in which the fiber orientation is randomly distributed in the plane of the web or fabric, are used now commercially in the manufacture of a variety of liquid absorbent products. Generally, in the air forming process the fibers, which may be cellulosic, synthetic, or a combination of both, are suspended in a gas stream (e.g., air) and then conveyed to a forming screen where the fibers are formed or condensed into a web. However, the resulting web lacks integrity, and therefore one of several techniques is used to bond the fibers and thereby stabilize the structure. The fabric products produced are soft, flexible and porous, and are suitable for a number of commercial products, particularly disposable products. The fiber content, at least to a large extent, used in many of these products is hydrophilic or can be rendered hydrophilic, and therefore the products are especially useful as liquid absorbent products, such as disposable diapers, incontinent pads, wipes, feminine napkins, and filtration materials.

[0003] In the conventional manufacture of air laid products, the loose web condensed on the forming screen is typically stabilized by mechanical, thermal, or chemical means. Mechanical or thermal means have been used extensively, and usually require fiber entanglement or fiber bonding. Chemical bonding utilizes a solvent or adhesive, and United States Patent 3,575,749 to Kroyer discloses bonding the fibrous layer with a latex binder, which may be applied to one or both sides of the web. It has long been recognized, however, that chemical bonding with a latex binder is disadvantageous for use in certain products in that the binder impairs the wipe dry characteristic of the web in that the web has poor retention of the liquid.

[0004] More recently, water insoluble hydrogels or superabsorbent materials, typically in particle form, have been incorporated into the fibrous web in order to increase the absorptive capacity of the web. These hydrogels have an absorptive capacity for water and body fluids far exceeding that of the hydrophilic fiber, e.g. wood pulp fiber used in the web, and in fact are capable of absorbing twenty times or more their own weight of water and retain this fluid under pressure. Hydrogel particles have two serious limitations, however, that initially have militated against their acceptance in absorptive fibrous products. One limitation is the hydrogel particles, if not used properly, exhibit gel blocking, a phenomenon that inhibits liquid transmission to the interior; and, secondly, when hydrogel particles are incorporated into a web or fabric, the particles tend to migrate or sift and as a consequence, during manufacture, storage or use, the particles migrate from the useful part of the product or can be lost or cause dust. These limitations needed first to be resolved before hydrogels could be utilized to any appreciable extent in liquid absorbent products, e. g. disposable diapers. The prior art is replete with different mechanical means to achieve this objective, typically involving a roller compression or densification step. In United States Patent Number 4,610,678 to Weisman et al., the web bearing the superabsorbent is densified by calender rolls, and the patent expressly avoids the use of solvents or other liquids which, as stated at column 2 of the patent, can impair the absorptive capability of the hydrogel and impart stiffness to the product. In United States Patent Number 4,260,443 to Lindsay et al., the web containing hydrogel particles is embossed to provide land areas of adhesion and thereby confine the hydrogel to the desired areas. A disposable absorbent is disclosed in United States Patent Number 4,500,315 to Pieniak et al., comprising a fibrous layered structure with the superabsorbent sandwiched between layers, and the composite is then compressed.

[0005] Still further, United States Patent Number 4,640,810 to Laursen et al. discloses a system for forming an airlaid web, and proposes that a superabsorbent material may be incorporated into the web. The airlaid product is useful for disposable diapers, feminine napkins, underpads, and liquid filters. The patent also discloses in a general manner that the fibrous layer can be bonded to impart integrity to the web, and although alternate bonding methods are suggested, the patent describes using only heated embossing rollers in conjunction with the inventive process and apparatus. The background section of the Laursen et al. patent discusses the Kroyer patent, supra, but hastens to conclude that stabilizing the web or fabric with latex for absorbent products has numerous manufacturing disadvantages and drawbacks, and places complete emphasis on stabilizing the web with heated rolls and embossing.

[0006] In fact, the use of superabsorbent materials and latex in the same web or batt is considered counterproductive in that the latex, which in conventional practice is applied as an aqueous emulsion or dispersion or solution, will block the powder and impair or completely destroy its effectiveness. For example, United States Patent Number 4,551,191 to Kock et al., which discloses an airlaid web containing superabsorbent material, states expressly that the absorption rate and capacity of the superabsorbent particles are adversely affected by certain process conditions such as those involv-

ing adhesives. This disadvantage was shown to be overcome by the teachings in United States Patent Number 4,600,462 to Watt, which discloses that impairment of the water absorbency of the fiber caused by the latex binder can be overcome by substantially coating the fibers of the formed web with an aqueous solution of a water soluble hydrophile, preferably after the application of the binder. According to Watt, the hydrophile interacts with the binding agent within the matrix to overcome water repellency.

[0007] This invention has therefore as its purpose to overcome the deficiencies of the prior art, and to provide a soft, absorbent structure that exhibits high integrity and relatively low bulk.

[0008] GB-A-2004201 describes a method of manufacturing absorbent structures wherein a liquid absorbing material, e.g. in the form of a powder, is incorporated between two fibrous pads and a liquid binding agent, e.g. an aqueous solution of poly(vinylalcohol) or an acrylic latex is applied to the external surface of one of the pads and percolates through to form an integral structure, by which is apparently meant that the powder is bonded to the pads.

[0009] EP-A-0 255 654 describes a method which comprises forming a dry-laid intimate mixture of cellulose fibers and superabsorbent polymer and binding the layer of fibers and polymers by hot calendering and embossing and then by application of a resin dispersion of the kind used for the dry-formation of paper sheets. For the last step a 5-20% aqueous dispersion of resin is employed in an amount of 5 to 12 parts of dispersion, by weight, per 100 parts by weight of mixture of fibers and polymer.

[0010] In its broadest aspect, the invention provides a dry laid, liquid absorbent structure that has high absorptive capacity, retention and rate of absorption and has stability or integrity, a high basis weight and low bulk. A method of forming the structure is also provided.

[0011] Thus, according to the present invention, there is provided a method for making a dry laid, liquid-absorbent structure having a basis weight of about 20 to 500 grams per square meter by forming a dry laid loose fibrous web having incorporated therein particulate superabsorbent material, applying to at least one surface of said web a liquid binding agent and curing the agent; characterised in that said liquid binding agent comprises a heat curable latex which is applied in an amount to form, after curing, from 5% to 30% by weight of the structure, and the amount of latex applied and the degree of penetration of the latex into said structure are controlled so as to impart integrity to the structure on curing and to provide said cured structure with an absorptive capacity of not less than about 6 grams of a one percent saline solution per gram of structure and a retention capability of not less than about 5 grams of a one percent saline solution per gram of structure.

[0012] The invention also provides a dry laid, liquid-absorbent structure comprising a loose dry-laid fibrous web having distributed therewithin particulate superabsorbent material, and said web being stabilised by a binding agent for the structure comprising heat curable latex which has partially penetrated into the web from at least one surface of said web and is then cured, said cured latex forming from 5% to 30% by weight, based on the weight of the structure and said structure having (i) a basis weight of about 20 to 500 grams per square meter, (ii) an absorptive capacity of not less than about 6 grams of a one percent saline solution per gram of structure, and (iii) a retention capability of not less than about 5 grams of a one percent saline solution per gram of structure.

[0013] According to the process of the invention, a dry laid web, preferably airlaid, is first formed having incorporated therein a water insoluble hydrogel or superabsorbent. A liquid latex is applied to at least one surface of the resulting web, and the latex is rendered active as by curing with heat. The latex is applied in sufficient quantity to impart integrity to the structure without substantially impairing the effective absorbent capacity of the hydrogel to absorb liquid by controlling the depth of penetration of the latex into the web and the degree of coverage of the hydrogel particles by the latex.

[0014] A conventional air forming system includes two or more distributors, and fibers are conveyed from each distributor to the forming screen, whereby plies of fibers are condensed on the screen as a web. The hydrogel or superabsorbent material may be incorporated into the fibrous plies or web at any convenient or desired point in the system, such as between plies or within the plies. Water insoluble hydrogels or superabsorbent materials, which are well known and commercially available polymeric materials, are applied to the fibrous layer or batt as a solid and in particulate form, which may include, for example, powders, particles, flake, fibers, globules, and the like. Typically, the hydrogel is distributed or deposited onto a layer or ply of fiber about midway during the formation of the web. Where desired, the absorbent structure may include a porous reinforcing web either as an outside layer, or as an interjacent layer with the hydrogel applied to one side only of the reinforcing web. A suitable reinforcing web may include, for example, creped paper, 3-D formed paper which is characterized by relatively large number of fiber-filled nubs, or scrim which typically is of a polyester or polyolefin material. The fibers used in the manufacture of the structure may be cellulosic (including modified cellulosic), synthetic or a combination, and may be either hydrophilic or hydrophobic. Such fibers include, for example, wood pulp fibers, rayon, polyethylene and polypropylene. When such fibers are dry laid, there is some mechanical entanglement but not sufficient to provide good integrity to the structure. A latex emulsion or solution, typically in an aqueous medium, is applied to one or both surfaces of the web to provide a latex coating which partially impregnates the web, and upon curing stabilizes the structure. The latex may be applied to the web by any suitable means such as spraying, brushing, flooding, rolling, and the like. The amount of latex applied and the degree of penetration of the latex

are controlled so as to avoid impairing the effective absorbency of the hydrogel, thereby achieving a product of relatively high basis weight exhibiting on an area basis high absorbency as compared to similar prior art webs comprised of fiber and hydrogel only. This invention provides a web or pad that is thinner for equal area relative to the prior art webs, yet exhibits favorable absorbency and retention properties at a relatively high breaking length.

[0015] Because the fibrous structure of the present invention exhibits high liquid absorbency and retention, including body fluids, is soft, and has low bulk, the structure is especially useful in disposable products such as diapers, feminine pads, wipes, towels, and in filtration media.

[0016] The invention will now be described in greater detail with reference to specific embodiments thereof and with the aid of the accompanying drawings in which

Figure 1 is a schematic flow diagram of a process for making a liquid absorbent structure in accordance with the present invention;

Figure 2 is a cross-sectional view on an enlarged scale of an absorbent structure made in accordance with the present invention;

Figures 3A and 3B are schematic flow diagrams of a process of the invention similar to that of Figure 1 but embodying a modification;

Figures 4A and 4B are cross-sectional views of alternative embodiments of structures made in accordance with the modified processes of Figures 3A and 3B;

Figure 5 is a perspective view partially broken away illustrating another embodiment of the absorbent structure of this invention and particularly useful as a diaper;

Figure 6 is a perspective view of a sanitary napkin embodying the structure of this invention, and partially broken away to illustrate the structure;

Figure 7 is a perspective view of a wipe or towel embodying the structure of this invention, and partially broken away to illustrate the structure;

Figure 8 is a perspective view of a partially rolled blank fabric structure and partially broken away to illustrate the details of the absorbent structure of the invention;

Figures 9 and 10 are graphs showing absorption and retention curves for an absorbent structure made in accordance with the invention with a one percent saline solution and with de-ionized water; and

Figures 11 and 12 are graphs similar to Figures 9 and 10 showing absorption and retention curves.

DETAILED DESCRIPTION OF THE INVENTION

[0017] The absorbent structures of the present invention may be made using conventional equipment designed for dry laying systems, and although the invention is described hereinbelow with particular reference to airlaid structures, it should be understood that other dry laid systems, e.g. carding, are also applicable.

[0018] Referring to the drawings wherein like reference numerals refer to similar parts throughout, there is shown in Figure 1 a preferred embodiment for the manufacture of the liquid absorbent structure of the invention. In accordance with this embodiment, the air forming system, indicated generally by the numeral 10, includes a distributor unit 12 disposed transversely above a continuous forming screen 14 mounted on rollers 16 and driven by a suitable motor (not shown), and vacuum means or suction box 18 is positioned beneath the screen. In a conventional air forming system, upstream of the distributor unit is a defibrator or feeder (not shown), such as a hammermill or Rando-Feeder, where bales, laps or the like are defiberized, and further the fibers may be cleaned and/or blended if necessary or desired depending largely on the type of fibers used, the blend of fibers used, and the end product sought. For example, wood pulp fibers can be blended with synthetic fibers and applied as a blend by the distributor, or each distributor can convey a different fiber to the screen to form separate plies or layers. The fibers are carried by an air stream via conduit 20 to the distributors. The porous forming screen 14 is essentially coextensive with the distributors, and the suction box 18 beneath the screen draws the air stream downwardly and conveys the fibers to the surface of the screen thereby forming plies or a loose web 22. At this stage in the process, the web exhibits little integrity, and the vacuum means retains the loose, fibrous web on the screen. It should be understood that the system may be modified to control the composition and thickness of the end product. For example, the distributor unit typically comprises a plurality of individual distributors, and although Figure 1 shows schematically four distributors at 12A, 12B, 12C and 12D, this number of distributors and particular arrangement can be altered or varied depending on such factors as machine speed, capacity, type of fibers, and end product desired.

[0019] Web 22 formed on screen 14 has incorporated therein a water-insoluble superabsorbent material. In a preferred embodiment as shown in Figure 1, a dosing unit or feed hopper 24, containing superabsorbent particles 26, is positioned in the middle of the distributor unit, i.e. between distributors 12B and 12C. In this manner, superabsorbent particles are deposited between plies of fluff laid by each distributor. That is, the superabsorbent particles are discharged from hopper 24 onto the moving layer of fluff laid down by distributors 12A and 12B, and the plies of fluff laid

down by distributors 12C and 12D are laid over the superabsorbent particles. It should be understood, however, that the plies are relatively porous, and therefore the particles tend to migrate somewhat into adjacent plies. Where desired, the superabsorbent particles may be blended with the fibers in one or more distributors, such as in distributor 12B or 12C, thereby forming a web with superabsorbent particles intermixed with one or more fibrous plies of the web.

[0020] At this stage of the process, the web 22 condensed on forming wire 14 has very little integrity and requires stabilization. The web is advanced by the continuous screen, and where desired, the web first may be passed between compression rollers 28, which may be heated, to densify the web, but this step is optional. This densification step enhances the penetration of the latex into the web, and the degree or percent of densification can vary depending on such factors as the amount of hydrogel, basis weight of the web, the desired degree of penetration of the latex into the web, and the end product sought. From there, the web is transported to a suitable dispensing means 30, such as a spray nozzle, doctor blade, roller applicator, or the like, where a latex binder is applied to the surface of the loose web. A vacuum applied by suction box 31 positioned beneath the dispensing means and screen helps to draw the latex into the web. The dispensing means or applicator is essentially coextensive with the width of the web, and preferably a substantially uniform coating is applied to the web surface. However, the latex may be applied as a nonuniform, random or pattern coating, and because the latex is water-based, it will diffuse throughout the web and function as a binder when cured. The latex when cured imparts integrity to the web, and therefore some penetration of the latex is required. The extent or degree of penetration of the latex into the web is controlled by controlling the amount of latex applied and by controlling the vacuum applied to the web in that the vacuum helps to draw the latex into the web. The latex is usually applied as an aqueous emulsion, and is a thermosetting plastic. In order to activate the latex, the latex emulsion contains a suitable curing agent or cross-linking agent, and after the web is coated, the latex is cured to effect cross-linking. Most typically, curing is accomplished by passing the coated web through a hot air oven or through air drier 32, and the temperature typically ranges from about 93 to 260°C 200 to 500°F but this depends upon the specific type of latex resin used, upon the curing agent or cross-linking agent, upon the amount of latex, the thickness of the web, the degree of vacuum, and the machine speed. It is desirable to coat both surfaces of the web with latex, and this is readily accomplished by reverse rolling the web so that the top surface at the dispensing means 30 becomes the bottom surface. Thus, web 22 is transferred to a second screen 34 and then advanced to a second dispensing means 36, including suction box 37, where latex is now applied to the opposite side. This second latex coating is likewise cured by passing the web through a second oven 38 within about the same temperature range.

[0021] The resulting web structure 40 exiting from the last oven now exhibits sufficient integrity and can be cut, rolled, packaged, etc. As shown, the web 40 is taken up on roller 42, and may be used as stock for a finished product such as of the type described below in detail.

[0022] The fibrous structure made in accordance with the foregoing process is illustrated in Figure 2. The structure, indicated generally by the numeral 44, comprises randomly distributed fibers 46, such as wood pulp fibers, and superabsorbent particles 48 randomly distributed in the web. It will be observed that the particles of hydrogel are more concentrated in the middle zone of the web, but some particles migrate to other sections of the web. Both surfaces of the web bear a latex coating 50, which has penetrated or impregnated the web to some degree and has partially coated some of the fibers and hydrogel particles. As explained above, the penetration is controlled so as not to substantially impair the absorbent capacity of the hydrogel.

[0023] Notwithstanding the latex coating, the web is soft yet strong and absorbent, exhibiting a relatively high tensile strength and breaking length. It is desirable for fibrous structures of this type to have relatively low bulk, because a more dense web, when compared to similar structures containing no latex and of about equal absorptive capacity but of higher bulk, can be thinner yet highly absorbent and consequently less bulky. A reduction in bulk, which means a reduction in volume the web is occupying, without sacrificing significantly other desired properties is important from the standpoint of manufacturing, storage and packaging. Hence, for products of this invention the basis weight ranges from about 20 to 500 grams per square meter, and more preferably from about 75 to 350. There can be manufacturing constraints in producing a web having a basis weight lower than about 20 grams per square meter in that such a web lacks desired strength. When the basis weight exceeds the upper limit, the product may be too stiff and therefore not useful for most applications. The web structures should have a breaking length of not less than about 750 meters, and preferably not less than about 1000, as measured according to TAPPI method T 494 om-88 (except the TAPPI method was modified so that the rate of jaw separation was 100 mm/min). Breaking length, as defined by this TAPPI test is the calculated limiting length of a strip of uniform width, beyond which, if such a strip were suspended by one end, it would break of its own weight. Thus, a breaking length value less than this minimum results in a product that may be too weak for some applications.

[0024] The absorption capacity, retention, and absorption rate properties for the absorbent structures of this invention are particularly meaningful. The Gravimetric Absorbency Test is used by the industry to study and measure these properties, and the basic procedure and apparatus are described in Bergeni et al., Textile Research Journal, 37 (1967) 356, and in United States Patent Number 4,357,827 to McConnell. In accordance with the test, a porous plate of glass fiber is connected to a water reservoir which is placed over an analytical balance. The porous plate is supported by a vertical

slide assembly which allows one to adjust the height of the plate to the same level (or higher) as the water reservoir. Normally, the height of the porous plate is set at a hydrostatic tension of 1.5 cm over the water reservoir. This allows the sample to absorb as much fluid as it demands (demand wettability test) without flooding the sample. During the absorption and retention test, the plate height is automatically raised to 26 cm over the water reservoir. This allows the water to drain from the sample and simulate a wringing of the sample. Absorbent products used by the consumer undergo some form of pressure, and therefore the tests are conducted under 7 g/sq cm confining pressure, which about simulates a real life situation. When a sample is placed over the porous plate, the sample begins to absorb fluid. The water loss through the balance is recorded at five second intervals, and the test is terminated when the sample can no longer absorb or desorb 0.02 grams of fluid within 15 second intervals at a given height. Knowing the sample weight, the water absorption ratio can be calculated. Therefore, the absorption and retention values are based on the hypothetical value of the water absorbed by one gram of the sample. The values obtained are a measurement of the capabilities of the materials being tested, in that a higher absorption value indicates a higher absorptive capacity, and a higher retention value indicates a better wipe dry characteristic or holding the fluid under pressure.

[0025] Accordingly, the absorbent structures of this invention exhibit an absorptive capacity of not less than about six grams of a one percent saline solution per gram of structure, and preferably, about eight grams, as measured by the Gravimetric Absorbency Test. The absorption rate, which is an indication of how fast a sample can absorb fluid, can be determined from the initial slope of the absorption curve. The higher or steeper the absorption curve, the faster the absorption rate. The absorption rate depends on such factors as type of fibers, type of hydrogel, and density or basis weight of the structure. Also, the retention property is meaningful because the consumer most typically is applying some form of pressure to the structure when in use. Hence, the structures exhibit a retention capability of not less than about five grams of a one percent saline solution per gram of structure, and preferably not less than about six grams.

[0026] Any of a variety of fibers, including a blend or admixture, can be used in the absorbent structure of this invention. The fibers may be cellulosic, modified cellulosic, or synthetic, and include such fibers as wood pulp, rayon, cotton, cellulose acetate, polyester, polyethylene, polypropylene, nylon, and the like. A fibrous web comprising cellulosic fibers such as wood pulp fibers is particularly useful in such products as disposable diapers or wipes because the cellulose is liquid absorbent and therefore enhances the overall absorbency of the structure. Products of this type also advantageously use a blend of cellulosic and synthetic fibers. In one embodiment, the web comprises at least about 50 percent by weight cellulosic fibres and optionally up to about 50 percent by weight synthetic fibres. Products of this type typically comprise about 65 to 95 weight percent cellulosic fibers, and more preferably up to about 20 percent by weight of the synthetic fiber. The synthetic fiber, which can be provided in any length including staple-length can improve the strength of the structure, but its content is frequently limited because it decreases the rate of absorbency of the structure. A structure comprising all synthetic fibers can be useful in such applications as a filter medium. Thus, the type of fiber and particular blend can be varied depending upon the end product. In addition to the foregoing uses, the structures of this invention can be used for incontinent pads, diaper core, diaper insert, and for surgical and wound bandages.

[0027] A wide variety of superabsorbent materials or hydrogels are well known and readily available from a number of sources. Superabsorbent polymers useful in the absorbent structures of this invention are substantially water insoluble but water swellable, and comprise, for example, saponified starch-polyacrylonitrile graft copolymers, starch-polyacrylic acid graft copolymers, cross-linked/grafted cellulose, saponified vinyl acetate-acrylic acid copolymers, starch grafted polyvinyl acetate, acrylic acid polymers, cross-linked polyethylene oxide, isobutylene maleic anhydride copolymers, and the like. The hydrogels used in the fibrous web structures may be the same or a mixture of absorbent polymers, and are incorporated into the web as a discontinuous solid material. The amount of hydrogel can vary widely depending on the end use of the product, and the weight percent can be determined, taking into account the end use, through experiment by one having skill in the art. For example, if the absorbent structure is used in a wipe or towel, a useful range for the hydrogel has been found to be from as low as 10 percent up to about 65 percent by weight. If used in a diaper or feminine pad (sanitary napkin), the weight percent hydrogel usually ranges from about 10 to 65 weight percent of the structure, and preferably from about 15 to 55 weight percent. If for the end use application sought, the percent hydrogel is too low, the product will not be sufficiently absorbent because the latex does obscure to some extent the absorbent properties of both the hydrogel and fibers. On the other hand, there appears to be no benefit in using an excessive amount or more than a predetermined maximum, but it should be understood that the amount can vary depending on such factors as type of fiber, the absorbent capacity of the hydrogel for the particular fluid to be absorbed, the amount of latex, and basis weight of the structure. The absorbent particulates may be in the form of fibers, flakes, particles, granules, powder, and the like. Particularly useful hydrogels comprise particles having a size of from about 40 to 700 microns. Particulate within this size range are relatively easy to handle and further ensure a rapid and even distribution of such particles in the web. Also, particles that are too small have a greater tendency to migrate or sift from the structure and be lost or generate excessive dust.

[0028] The latex is applied as an aqueous emulsion or dispersion, which typically contains about 45 to 65 percent solids, and these materials are readily available from several manufacturers. Because the latex emulsions are water miscible, they may be further diluted, if desired, before being applied to the web. Also, these latex compositions are ther-

mosetting, and in order to effect cross-linking, they contain a small amount of a suitable cross-linking agent which is a well known chemical agent for this purpose, such as N-methylolacrylamide. Latices available are classified by chemical family, and those particularly useful include vinyl acetate and acrylic ester copolymers, ethylene vinyl acetate copolymers, styrene butadiene carboxylate copolymers, and polyacrylonitriles, and sold, for example, under the trade names of Airbond, Airflex and Vinac of Air Products, Inc., Hycar and Geon of Goodrich Chemical Co., and Fulatex of H. B. Fuller Company. The amount of latex used in the structure cannot be so high as to substantially impair or obscure the effective absorbent properties of the hydrogel and hydrophilic fibers, or as to impart a stiffness to the structure as to render it impractical. We have found that the latex may range from about 5 to 30 weight percent of the structure, and preferably from about 10 to 20 weight percent.

[0029] In modified embodiments, a porous reinforcing web such as creped paper, 3D formed paper, or scrim, may be incorporated into the fibrous web structure either as a surface web or as an intermediate web disposed interjacent the surfaces of the fibrous web.

[0030] These embodiments will now be described with reference to Figures 3A, 3B, 4A and 4B and with particular reference to scrim. Figures 3A and 4A relate to the embodiment wherein the web is a surface web and Figures 3B and 4B relate to the embodiment wherein the web is an intermediate web disposed between the surfaces of the fibrous web.

[0031] Referring to Figure 4A, the structure 59 comprises fibers 60 and hydrogel particles 61 interspersed in the web but more concentrated in the middle zone. Scrim 62 is formed on one surface of the web structure, and the opposite surface bears a cured latex coating 64.

[0032] One method of forming structure 59 is illustrated in Figure 3A wherein reference numerals which are in common with those in Figure 1 relate to like features. Referring to Figure 3A, the air forming system shown generally at 10 is similar to that shown in Figure 1. The scrim 52A, which typically is a polyester or polyolefin, is fed from a source roll 53 across idler roll 54 and onto the continuous screen 14. Fibers from distributor 12A are conveyed onto the scrim to form a first ply, and the fibers become somewhat mechanically entangled with the scrim. Additional fibers and hydrogel particles are conveyed as in Figure 1 to the screen zone bearing scrim and fibers to build the desired loose web. The fibrous web is then transported to dispensing means 30 where the latex emulsion is applied, and the latex is cured on passing through hot air oven 32. The structure is then wound on roller 55.

[0033] Figure 3A also shows a second latex dispensing means 36, 37 and drier 38 for disposing latex on to the other face of the structure, that is the face containing scrim 62 (Figure 4), if desired.

[0034] Figure 4B, wherein the reference numerals which are common with Figure 4A represent like features, illustrates a structure wherein the reinforcing web (scrim) 62 is disposed between the surfaces of the fibrous web. One method of forming this alternative structure is illustrated in Figure 3B wherein reference numerals which are common with those of Figure 1 represent like features. Referring to Figure 3B, scrim 52B is fed from source roll 57 positioned intermediate the distributors, such as between distributors 12B and 12C as shown, and into converging relation with formed plies condensed on the screen from the distributors positioned upstream of roll 57. Superabsorbent material from hopper 24 is deposited onto the scrim surface, and additional plies of fibers are formed over the superabsorbent particles. A latex is then applied to one surface of the fibrous web, using latex dispensing means 30, the latex is cured by drier 32 and the finished structure is wound on roller 58, as described above. If both surfaces of the web are to be coated with latex, the second surface is coated using dispensing means 36 and the latex cured by drier 38.

[0035] The embodiment with the scrim interjacent the surfaces has the desirable feature in that the scrim prevents the hydrogel particles from migrating to the underside of the fibrous web thereby maintaining the particles in the desired location toward or in the vicinity of the center of the web.

[0036] Scrim material, which is a useful reinforcement for fibrous webs, is readily available from several sources, and typically comprises a polyester, polyethylene, polypropylene or polyacrylic. Particularly useful materials for these embodiments of the invention include scrim having an opening ranging from about 20 to 700 microns and a denier of from about 1.2 to 5. Also, a woven scrim with openings of from about .1 to 7 mm can be used.

[0037] Figures 5 through 8, inclusive, depict useful products embodying the fibrous structure of this invention. There is shown in Figure 5 a diaper comprising a moisture-permeable facing member 66 for the body-side of the pad, such as a nonwoven polypropylene fabric, and a puncture-impervious backing member 68, such as a polyethylene film or sheet. The diaper is the typical hour-glass configuration with cut-out leg sections 70 and crotch section 72. Tabs 74 are provided in order to secure the diaper around the waist of the wearer. In the middle portion or crotch section, there is provided the fibrous absorbent structure or core of the type shown in Figure 2, comprising fibers 76, preferably wood pulp fibers which, if desired, may be combined with up to about 20 percent by weight synthetic fibers, and superabsorbent particles 78. A latex coating 80 is provided on both surfaces, and the latex partially penetrates the web and coats a portion only of the fibers and hydrogel particles. The diaper is sealed along the marginal edges by conventional means. The body fluid permeates fabric 66, and because of the wicking action of the fibers, the fluid is transported to all areas of the batt and absorbed by the hydrogel and fibers. The facing fabric, being liquid-permeable, is perceived by the wearer as dry even when the inner batt or web is saturated. Because the liquid absorbent structure is relatively dense and exhibits high absorbency, the diaper made utilizing this structure is exceptionally thin, and the absorbency rate

compares very favorably with a more bulky pad bearing no latex. (Absorbency rate and comparative data are discussed in greater detail with reference to Figures 9 through 12, below.) It should be understood that the term "diaper" as used herein and in the appended claims includes adult incontinent diapers.

[0038] There is shown in Figure 6 a feminine napkin with a broken away portion to illustrate the construction of the pad. The napkin comprises a moisture-permeable facing member 82, such as a nonwoven fabric, a moisture-impermeable backing member 84, such as a polyethylene film, and the napkin is sealed along the marginal edges in a conventional manner. The absorbent core comprises fibers 86, hydrogel particles 88, and latex coating 90. The absorbent structure for this feminine pad is soft, dense, and highly absorbent.

[0039] Another useful embodiment of the invention is shown in Figure 7, which depicts a wipe 100 comprising fibers 102, hydrogel particles 104, and latex coating 106. As with the other structures, the fibers may consist of cellulosic fibers, synthetic fibers, or a blend of fibers. The latex coating imparts integrity to the structure in that it exhibits relatively high tensile strength and breaking length without substantially impairing the absorptive capacity.

[0040] Figure 8 shows a partial roll illustrating how a blank of the absorbent structure can be used, for example, as a diaper or diaper insert. The roll, indicated generally by the numeral 108, comprises a plurality of blanks 110, and a single blank can be separated from the roll along score line 112. Each blank is sealed along its marginal edges by a glue line or other sealant means (not shown). If the blank is to be used as a diaper, diaper insert or training pant insert, the blank can have the conventional hour-glass configuration such as shown in Figure 5. Also, a roll of feminine napkins could be provided with the napkins rolled about its longitudinal axis (the long axis), and each napkin separable from the roll along the score line. If used as a wipe or towel, the blank can have a rectangular shape. Each blank comprises fibers 114, superabsorbent particles 116, and a latex coating 118. Because the absorbent structure has a relatively high density or low bulk, a large number of blanks can be provided in roll form, which is a convenience and advantage. For example, a roll approximately 127 mm (five inches) in diameter on a 38 mm (one and one half inch) core (such as for a paper towel) may comprise about 15.24 lineal meters (50 lineal feet). It would be impractical to form such a roll with conventional absorbent structures which are more bulky, i. e. less dense. In the following examples, samples were made substantially in accordance with the procedure shown in Figure 1. Accordingly, layers of fibers were airlaid and hydrogel particles deposited between layers to form the loose web. The webs were densified, both sides of each web impregnated with latex, and the webs then dried in a forced hot air oven.

EXAMPLE 1

Absorbent webs approximately 30 by 30 cm were prepared using 100% Southern pine bleached Kraft pulp from Weyerhaeuser Company at a basis weight of about 100 g/m^2, and 1M-1500 superabsorbent powder manufactured by Celanese Chemical Co. was added at a weight of about 80 g/m^2. The webs were coated on both sides with A-109 (K) latex from Air Products and Chemicals, Inc., and the resulting webs comprised about 17% by weight latex. The webs, identified as Samples "1" and "2", were tested for absorption and retention with a 1% saline solution and with water using the Gravimetric Absorbency Testing unit described above. The structures of this invention were compared with control structures prepared as above except no superabsorbent material was incorporated into the web. The results are shown in Table I below, with Sample 1 and Control "A" being tested with the saline solution and Sample 2 and control "A" being tested with deionized water.

TABLE I

Absorption/Retention				
Sample	Test Fluid	Basis Weight g/m^2	Absorption g/g	Retention g/g
A	Saline	120	9.3	1.3
1	Saline	190	11.3	8.1
A	Water	120	9.2	1.6
2	Water	256	84.5	58.6

The results of the tests were plotted, and the graphs are shown in Figures 9 and 10. The ordinate shows absorption in g/g and the abscissa represents time in seconds. It will be observed from Table I and the graphs that the control samples achieve a relatively good maximum absorbency in about 8 or 9 seconds but when they were subjected to a higher hydrostatic tension, the capacity drops off showing poor retention. In contrast, the structures of this invention exhibit relatively good absorbency and, most significantly, exhibit exceptional retention which is important because when in actual use, the structures are subject to pressure.

EXAMPLE 2

[0041] In order to further demonstrate the structure of the present invention, comparative tests were conducted as in Example 1 using the same materials for the inventive structure and for the one control (Control A). In addition, a comparison was made between a second control (Control B) comprising Kittyhawk fluff from Weyerhaeuser Company containing 20 weight percent polyethylene fiber, and hydrogel as in Example 1, but no latex was used in Control B. The absorptivity results are illustrated in Figures 11 and 12 and Table II. It will be observed from Figure 11 that the absorbency rate measured using a 1% saline solution for the structure of the invention is almost as fast as Control A and much faster than Control B. Thus, for the invention, maximum absorbency of about 13.76 grams per gram was achieved in about 5 minutes; whereas Control B reached the same capacity in about 9 minutes. Control B showed a maximum absorbency of about 15.6 after about 22 minutes and equaled the absorbency of the invention after about 12 minutes. However, the retention property for Control A is relatively poor, whereas the retention property for the inventive structure is very high. Similar results are shown in Figure 12 where the absorbency rate and capacities were measured using deionized water. Here, the inventive product Sample "3", had a maximum absorbency of about 32.3 grams per gram in about 13 minutes and again excellent retention; whereas Control A had maximum absorbency of about 6.8 in about 1 minute and poor retention, and Control B had maximum absorbency of about 51.5 in about 21 minutes. Data shown in Table II indicates that the water absorption rate was much higher within 2 minutes for the inventive product Sample "3", as compared to the sample bonded with 20% synthetic fiber. This higher initial absorption rate is important for products such as diapers since the material should absorb fluid within 1 minute of sudden discharge.

TABLE II

Absorption Rate							
Product	Basis Weight g/m	saline (1%)			Water		
		ml/1 min	ml/2 min	ml/5 min	ml/1 min	ml/2 min	ml/5min
Control "A"	86	6.55	---	---	6.78	---	---
Sample "3"	170	9.60	11.63	13.76	13.71	18.63	27.74
Control "B"	311	5.83	7.54	11.07	6.37	13.97	32.67

Thus, as shown by the graphs in Figures 11 and 12, the structure of the present invention exhibits fast absorbency and excellent retention, thereby making the product a useful liquid absorptive structure such as for body fluids.

EXAMPLE 3

[0042] As a further test, the absorbent structure was made on a pilot machine using two distributors for air laying fibers and a dozing unit positioned between the distributors for depositing hydrogel particles. The web comprised JDL fluff pulp from ITT Rayonnier at a basis weight of approximately 100 g/m^2, Aquakeep 10 SHP superabsorbent powder at a weight of about 80 g/m^2 from Norsolor Chemical Company, and Vinumul 33003 latex at a weight of approximately 10 g/m^2/side. The Vinumul 33003 latex is a vinyl acetate ethylene emulsion with an anionic surfactant from Vinumul which is a subsidiary of National Starch Company. The basis weight for samples tested from the web structure varied from about 177 to 227 g/m^2. The structure had a breaking length of about 6079 meters in the machine direction and 5111 meters in the cross direction (TAPPI T 494 om-88, described above), which shows relatively high strength for webs of this type. Absorption and retention test data in grams of solution per gram of fibrous web for a 1% saline solution are shown in Table III below.

TABLE III

Absorption/Retention	
5 seconds absorption	3.1 g/g
10 seconds absorption	5.7 g/g
15 seconds absorption	8.2 g/g
maximum absorption	12.8 g/g

TABLE III (continued)

Absorption/Retention	
maximum retention	10.7 g/g

[0043] Here again, the results show that a structure of the present invention exhibits not only relatively high absorption but excellent retention of fluid. From the foregoing, it will be observed that the structures are particularly useful in absorbent products, such as those used in absorbing body fluids and as filters.

[0044] The excellent combination of physical, tactile and liquid absorbence properties of the structure of the invention results from the unique combination of dry laid fibers, particulate superabsorbent material and latex coating and in particular from employing the latex coating in an amount which is sufficient to impart integrity to the structure but which is not such as to substantially impair the effectiveness of the superabsorbent material to absorb liquid. By controlling the amount of latex employed, it is possible to control the extent of surface coating by the latex, the depth of penetration of the latex into the structure and the degree of coverage of the superabsorbent material by the latex. In the structure of the invention, the latex coating is discontinuous and by virtue of their being surrounded by fibrous material the superabsorbent particles are largely unaffected by the latex. The coverage of the particles by the latex is even further restricted in the preferred case where they are located in a generally central portion of the structure.

Claims

1. A method for making a dry laid, liquid-absorbent structure having a basis weight of about 20 to 500 grams per square meter by forming a dry laid loose fibrous web having incorporated therein particulate superabsorbent material, applying to at least one surface of said web a liquid binding agent and curing the agent;
characterised in that said liquid binding agent comprises a heat curable latex which is applied in an amount to form, after curing, from 5% to 30% by weight of the structure, and the amount of latex applied and the degree of penetration of the latex into said structure are controlled so as to impart integrity to the structure on curing and to provide said cured structure with an absorptive capacity of not less than about 6 grams of a one percent saline solution per gram of structure and a retention capability of not less than about 5 grams of a one percent saline solution per gram of structure.

2. A method as claimed in Claim 1 characterised in that vacuum is applied to the web to control the degree of penetration of the latex into the web.

3. A method as claimed in Claim 1 or Claim 2 characterised in that the formation of the dry laid fibrous web comprises: (i) dry laying fibers to form a first fibrous web, (ii) depositing particulate superabsorbent material on to one surface of said first fibrous web, and (iii) dry laying fibers onto said one surface to form a second fibrous web thereby resulting in a composite web with entrained superabsorbent.

4. A method as claimed in Claim 1 or Claim 2 characterised in that the formation of the dry laid fibrous web comprises: (i) dry laying fibers to form a first fibrous web, (ii) applying to one surface of said first fibrous web a porous reinforcing member, and (iii) dry laying fibers onto the exposed surface of said reinforcing member to form a second fibrous web thereby forming a composite web; particulate superabsorbent material being incorporated in at least one of said first and second fibrous webs.

5. A method according to any one of Claims 1 to 4 characterised in that said latex is applied to both surfaces of said web.

6. A method as claimed in Claim 1 or Claim 2 characterised in that formation of the dry laid fibrous web comprises: (i) providing a porous reinforcing member, and (ii) dry laying on at least one surface of said reinforcing member, fibers to form a dry laid fibrous composite web having incorporated therein particulate superabsorbent material, and liquid latex is applied to the surface of said composite web opposed to the reinforcing member.

7. A method as claimed in Claim 1 or Claim 2 characterised in that the formation of the dry laid fibrous web comprises air laying wood pulp fibres to form a fibrous web having randomly incorporated therein solid particulate superabsorbent material, said superabsorbent material comprising from about 1 to 65 percent by weight of the weight of said structure, a liquid latex is applied to both surfaces of said web and said latex is cured to form said structure.

8. A method as claimed in Claim 1 or Claim 2 characterised in that it comprises: (a) air laying fibers comprising wood

pulp fibers to form a first fibrous web, (b) applying to one surface of said first fibrous web a porous reinforcing member, (c) air laying fibers comprising wood pulp fibers onto the exposed surface of said reinforcing member to form a second fibrous web having randomly incorporated therein solid particles of a superabsorbent material thereby forming a composite web, said superabsorbent material comprising from about 1 to 65 percent by weight of the weight of said structure, and (d) applying to both surfaces of said composite web a liquid latex and curing said latex.

9. A method according to Claim 7 or Claim 8 characterised in that said wood pulp fibers are admixed with up to about 50 percent by weight synthetic fibers.

10. A method according to any one of Claims 1 to 9 characterised in that said latex is activated by applying heat at a temperature of from about 93 to about 260°C (about 200 to about 500°F).

11. A method according to any one of Claims 1 to 11 characterised in that said web is densified prior to applying said latex.

12. A liquid absorbent structure comprising dry laid fibers, superabsorbent material and resin binder, characterised in that said structure comprises a loose dry laid fibrous web (46) having distributed therewithin particulate superabsorbent material (48), and said web being stabilised by a binding agent for the structure comprising heat curable latex (50) which has partially penetrated into the web from at least one surface of said web and is then cured, said cured latex forming from 5% to 30% by weight, based on the weight of the structure and said structure having (i) a basis weight of about 20 to 500 grams per square meter, (ii) an absorptive capacity of not less than about 6 grams of a one percent saline solution per gram of structure, and (iii) a retention capability of not less than about 5 grams of a one percent saline solution per gram of structure.

13. A dry laid structure according to Claim 12 characterised in that a porous reinforcing member (62) is provided on at least one surface of said fibrous web.

14. A dry laid, liquid absorbent structure as claimed in Claim 12 characterised in that it includes a porous reinforcing member (62) disposed substantially interjacent the surfaces of said fibrous web with solid particles of a superabsorbent material randomly incorporated in said fibrous web to one side of said reinforcing web.

15. A structure according to Claim 13 or Claim 14 characterised in that said reinforcing member is selected from creped paper, 3-D formed paper and scrim.

16. A structure according to any one of Claims 12 to 15 characterised in that said structure comprises about 10 to 20 percent by weight of latex.

17. A structure according to any one of Claims 12 to 16 characterised in that said fibrous web comprises cellulosic fibers, synthetic fibers, or an admixture of cellulosic fibers and synthetic fibers.

18. A structure according to Claim 17 characterised in that said fibrous web comprises about 65 to 95 percent by weight wood pulp fibers.

19. A structure according to Claim 17 characterised in that said fibrous web comprises at least about 50 percent by weight wood pulp fibers.

20. A structure according to Claim 19 characterised in that said fibrous web comprises wood pulp fibers optionally admixed with up to about 50 percent by weight synthetic fibers.

21. A structure according to any one of Claims 12 to 20 characterised in that the binding agent comprises heat curable latex which has partially penetrated into the web from both surfaces of said web and is then cured.

22. A structure according to any one of Claims 12 to 21 characterised in that said superabsorbent material comprises from about 1 to 65 percent by weight of said structure.

23. A structure according to Claim 22 characterised in that said superabsorbent material comprises from about 10 to 65 percent by weight of said structure.

24. A structure according to Claim 23 characterised in that said superabsorbent material comprises from about 35 to 55 percent by weight of said structure.

25. A structure according to any one of Claims 12 to 24 characterised in that said basis weight is from about 20 to 350 grams per square meter, said absorptive capacity is not less than about 8 grams per gram, and said retention capability is not less than about 6 grams per gram.

26. A disposable diaper containing as an absorbent pad a structure as claimed in any one of Claims 12 to 25 or obtained by a method as claimed in any one of Claims 1 to 11 and containing about 10 to 65 weight percent of said solid particulate superabsorbent material.

27. A sanitary napkin having a liquid-permeable facing member and an opposed liquid-barrier member and an interposed dry laid, liquid absorbent structure as claimed in any one of Claims 12 to 25 or obtained by a method as claimed in any one of Claims 1 to 11 and containing about 10 to 65 weight percent of said solid particulate superabsorbent material.

28. A wipe adaptable for absorbing liquids comprising a dry laid fibrous web as claimed in any one of Claims 12 to 25 or obtained by a method as claimed in any one of Claims 1 to 11 and containing about 10 to 65 weight percent of said solid particulate superabsorbent material.

29. An incontinent pad comprising a dry laid fibrous web as claimed in any one of Claims 12 to 25 or obtained by a method as claimed in any one of Claims 1 to 11.

30. A roll comprising a plurality of liquid absorbent pads, each of said pads separable from said roll along a transverse score line, each pad comprising a dry laid fibrous web as claimed in any one of Claims 12 to 25 or obtained by a method as claimed in any one of Claims 1 to 11 and containing about 10 to 65 weight percent of said solid particulate superabsorbent material.

Patentansprüche

1. Verfahren zur Herstellung einer trockengelegten, Flüssigkeit absorbierenden Struktur mit einem Grundgewicht von etwa 20 bis 500 g/m^2 durch Bilden eines trockengelegten losen Fasergewebes mit darin inkorporiertem, teilchenförmigen, superabsorbierenden Material, Aufbringen eines flüssigen Bindemittels auf mindestens eine Seite des Gewebes und Ausharten des Mittels, dadurch gekennzeichnet, daß das flüssige Bindemittel einen hitzehartbaren Latex umfaßt, der in einer solchen Menge aufgetragen wird, daß er nach dem Ausharten 5 Gew.-% bis 30 Gew.-% der Struktur ausmacht, wobei die aufgetragene Menge an Latex und der Eindringungsgrad des Latex in die Struktur so kontrolliert werden, daß der Struktur beim Ausharten Integrität verliehen wird und um die ausgehartete Struktur mit einer Absorptionskapazität von nicht weniger als etwa 6 g einer 1-% igen Salzlösung pro Gramm der Struktur und einer Retentionsfähigkeit von nicht weniger als etwa 5 g einer 1-% igen Salzlösung pro Gramm der Struktur zu versehen.

2. Verfahren gemaß Anspruch 1, dadurch gekennzeichnet, daß ein Vakuum auf das Gewebe aufgebracht wird, um den Eindringungsgrad des Latex in das Gewebe zu kontrollieren.

3. Verfahren gemäß Anspruch 1 oder Anspruch 2, dadurch gekennzeichnet, daß die Bildung des trockengelegten Fasergewebes umfaßt: (i) das Trockenlegen von Fasern zur Bildung eines ersten Fasergewebes, (ii) das Ablagern von teilchenförmigem, superabsorbierenden Material auf einer Oberfläche des ersten Fasergewebes und (iii) das Trockenlegen von Fasern auf dieser einen Oberfläche zur Bildung eines zweiten Fasergewebes, was zu einem Verbundgewebe mit darin enthaltenem Superabsorbens führt.

4. Verfahren gemäß Anspruch 1 oder Anspruch 2, dadurch gekennzeichnet, daß die Bildung des trockengelegten Fasergewebes umfallt: (i) das Trockenlegen von Fasern zur Bildung eines ersten Fasergewebes, (ii) das Auftragen eines porösen, verstärkenden Gliedes auf einer Oberfläche des ersten Fasergewebes und (iii) das Trockenlegen von Fasern auf der exponierten Oberfläche des verstärkenden Gliedes zur Bildung eines zweiten Fasergewebes, wodurch ein Verbundgewebe gebildet wird, wobei ein teilchenförmiges, superabsorbierendes Material in mindestens einem von erstem oder zweitem Fasergewebe inkorporiert ist.

5. Verfahren gemaß einem der Ansprüche 1 bis 4, dadurch gekennzeichnet, daß der Latex auf beiden Oberflächen

des Gewebes aufgetragen wird.

6. Verfahren gemäß Anspruch 1 oder Anspruch 2, dadurch gekennzeichnet, daß die Bildung des trockengelegten Fasergewebes umfaßt: (i) das Bereitstellen eines porösen, verstärkenden Gliedes und (ii) das Trockenlegen von Fasern auf mindestens einer Oberfläche des verstärkenden Gliedes zur Bildung eines trockengelegten Faserverbundgewebes mit darin inkorporiertem, teilchenförmigen, superabsorbierenden Material, wobei flüssiger Latex auf die dem verstärkenden Glied gegenüberliegende Oberfläche des Verbundgewebes aufgetragen wird.

7. Verfahren gemaß Anspruch 1 oder Anspruch 2, dadurch gekennzeichnet, daß die Bildung des trockengelegten Fasergewebes das Luftschichten von Holzpulpefasern umfaßt, um ein Fasergewebe mit statistisch darin inkorporiertem, festen, teilchenförmigen, superabsorbierenden Material zu erhalten, wobei das superabsorbierende Material etwa 1 bis 65 Gew.-% des Gewichts der Struktur ausmacht, und ein flüssiger Latex auf beide Oberflächen des Gewebes aufgebracht wird und der Latex zur Bildung der Struktur ausgehärtet wird.

8. Verfahren gemäß Anspruch 1 oder Anspruch 2, dadurch gekennzeichnet, daß es umfaßt: (a) das Luftschichten von Fasern, umfassend Holzpulpefasern, zur Bildung eines ersten Fasergewebes, (b) das Aufbringen eines porösen, verstärkenden Gliedes auf eine Oberfläche des ersten Fasergewebes, (c) das Luftschichten von Fasern, umfassend Holzpulpefasern, auf die exponierte Oberfläche des verstärkenden Gliedes zur Bildung eines zweiten Fasergewebes mit statistisch darin inkorporierten festen Teilchen eines superabsorbierenden Materials, wodurch ein Verbundgewebe gebildet wird, wobei das superabsorbierende Material etwa 1 bis 65 Gew.-% des Gewichts der Struktur ausmacht, und (d) das Auftragen eines flüssigen Latex auf beide Oberflächen des Verbundgewebes und das Aushärten des Latex.

9. Verfahren gemaß Anspruch 7 oder Anspruch 8, dadurch gekennzeichnet, daß die Holzpulpefasern mit bis zu etwa 50 Gew.-% synthetischen Fasern gemischt sind.

10. Verfahren gemäß einem der Ansprüche 1 bis 9, dadurch gekennzeichnet, daß der Latex durch Aufbringen von Wärme bei einer Temperatur von etwa 93 bis etwa 260°C (etwa 200 bis etwa 500°F) aktiviert wird.

11. Verfahren gemäß einem der Ansprüche 1 bis 11, dadurch gekennzeichnet, daß das Gewebe vor dem Auftragen des Latex verdichtet wird.

12. Flüssigkeitsabsorbierende Struktur, umfassend trockengelegte Fasern, ein superabsorbierendes Material und ein Harzbindemittel, dadurch gekennzeichnet, daß die Struktur ein loses, trockengelegtes Fasergewebe (46) mit darin verteiltem teilchenförmigem, superabsorbierenden Material (48) umfaßt, wobei das Gewebe durch ein Bindemittel für die Struktur stabilisiert wird, welches einen hitzehärtbaren Latex (50) umfaßt, der teilweise in das Gewebe von mindestens einer Oberfläche des Gewebes aus eingedrungen und anschließend ausgehärtet ist, wobei der ausgehartete Latex etwa 5 Gew.-% bis 30 Gew.-% ausmacht, bezogen auf das Gewicht der Struktur, und wobei die Struktur (i) ein Grundgewicht von etwa 20 bis 500 g/m^2, (ii) eine Absorptionskapazität von nicht weniger als etwa 6 g einer 1-% igen Salzlösung pro Gramm der Struktur und (iii) eine Retentionsfähigkeit von nicht weniger als 5 g einer 1-%igen Salzlösung pro Gramm der Struktur aufweist.

13. Trockengelegte Struktur gemäß Anspruch 12, dadurch gekennzeichnet, daß ein poröses, verstärkendes Glied (62) auf mindestens einer Oberfläche des Fasergewebes bereitgestellt wird.

14. Trockengelegte, Flüssigkeit absorbierende Struktur gemäß Anspruch 12, dadurch gekennzeichnet, daß diese ein poröses, verstärkendes Glied (62) umfaßt, welches im wesentlichen zwischen den Oberflächen des Fasergewebes mit festen Partikeln aus einem superabsorbierenden Material angeordnet ist, die statistisch in das Fasergewebe an einer Seite des verstärkenden Gewebes inkorporiert sind.

15. Struktur gemäß Anspruch 13 oder Anspruch 14, dadurch gekennzeichnet, daß das verstärkende Glied ausgewählt ist unter Krepppapier, dreidimensional geformtem Papier und Baumwollstoff.

16. Struktur gemäß einem der Ansprüche 12 bis 15, dadurch gekennzeichnet, daß die Struktur etwa 10 bis 20 Gew.-% Latex umfaßt.

17. Struktur gemäß einem der Ansprüche 12 bis 16, dadurch gekennzeichnet, daß das Fasergewebe Cellulosefasern, synthetische Fasern oder eine Mischung aus Cellulosefasern und synthetischen Fasern umfaßt.

18. Struktur gemäß Anspruch 17, dadurch gekennzeichnet, daß das Fasergewebe etwa 65 bis 95 Gew-% Holzpulpefasern umfaßt.

19. Struktur gemäß Anspruch 17, dadurch gekennzeichnet, daß das Fasergewebe mindestens etwa 50 Gew.-% Holzpulpefasern umfaßt.

20. Struktur gemäß Anspruch 19, dadurch gekennzeichnet, daß das Fasergewebe Holzpulpefasern, wahlweise gemischt mit bis zu etwa 50 Gew.-% synthetischen Fasern, umfaßt.

21. Struktur gemäß einem der Ansprüche 12 bis 20, dadurch gekennzeichnet, daß das Bindemittel einen hitzehärtbaren Latex umfaßt, der teilweise von beiden Oberflächen des Gewebes aus in das Gewebe eingedrungen ist und anschließend ausgehärtet ist.

22. Strukur gemäß einem der Ansprüche 12 bis 21, dadurch gekennzeichnet, daß das superabsorbierende Material etwa 1 bis 65 Gew.-% der Struktur ausmacht.

23. Struktur gemäß Anspruch 22, dadurch gekennzeichnet, daß das superabsorbierende Material etwa 10 bis 65 Gew.-% der Struktur ausmacht.

24. Struktur gemäß Anspruch 23, dadurch gekennzeichnet, daß das superabsorbierende Material etwa 35 bis 55 Gew.-% der Struktur ausmacht.

25. Struktur gemäß einem der Ansprüche 12 bis 24, dadurch gekennzeichnet, daß das Grundgewicht etwa 20 bis 350 g/m^2 beträgt, die Absorptionskapazität nicht unter etwa 8 g/g liegt und die Retentionsfähigkeit nicht unter etwa 6 g/g beträgt.

26. Wegwerfwindel, enthaltend als absorbierende Einlage eine Struktur gemäß einem der Ansprüche 12 bis 25 oder erhalten nach einem Verfahren gemäß einem der Ansprüche 1 bis 11 und enthaltend etwa 10 bis 65 Gew-% des festen, teilchenförmigen, superabsorbierenden Materials.

27. Binde mit einem flüssigkeitspermeablen Oberflächenteil und einem gegenüberliegenden flüssigkeitsdichten Teil sowie einer dazwischenliegenden trockengelegten, Flüssigkeit absorbierenden Struktur gemaß einem der Ansprüche 12 bis 25 oder erhalten nach einem Verfahren gemäß einem der Ansprüche 1 bis 11 und enthaltend etwa 10 bis 65 Gew.-% des festen, teilchenförmigen, superabsorbierenden Materials.

28. Wischtuch, welches an das Absorbieren von Flüssigkeit anpaßbar ist, umfassend ein trockengelegtes Fasergewebe gemäß einem der Ansprüche 12 bis 25 oder erhalten nach einem Verfahren gemäß einem der Ansprüche 1 bis 11 und enthaltend etwa 10 bis 65 Gew.-% des festen, teilchenförmigen, superabsorbierenden Materials.

29. Inkontinenzeinlage, umfassend ein trockengelegtes Fasergewebe gemäß einem der Ansprüche 12 bis 25 oder erhalten über ein Verfahren gemaß einem der Ansprüche 1 bis 11.

30. Rolle, umfassend eine Vielzahl von Flüssigkeit absorbierenden Lappen, wobei jeder Lappen von der Rolle entlang einer querverlaufenden Einkerbungslinie abtrennbar ist, wobei jeder Lappen ein trockengelegtes Fasergewebe, erhalten gemaß einem der Ansprüche 12 bis 22 oder erhalten über ein Verfahren gemäß einem der Ansprüche 1 bis 11 und enthaltend etwa 10 bis 65 Gew.-% an festem, teilchenförmigem, superabsorbierendem Material, umfaßt.

Revendications

1. Procédé de fabrication d'une structure absorbant les liquides, formée par dépôt à sec, ayant une masse surfacique d'environ 20 à 500 g/m^2 selon lequel on forme un tissu fibreux lâche déposé à sec dans lequel est incorporé un matériau superabsorbant particulaire, on applique un agent liant liquide sur au moins une surface dudit tissu et on durcit l'agent,
caractérisé en ce que ledit agent liant liquide comprend un latex thermodurcissable que l'on applique en une quantité formant, après le durcissement, de 5 % a 30 % en masse de la structure, et on règle la quantité de latex appliqué et le degré de pénétration du latex dans ladite structure de manière à donner par durcissement une intégrité à la structure et à fournir à ladite structure durcie une capacité d'absorption d'au moins environ 6 g d'une solution

salée à 1 % par g de structure et une capacité de rétention d'au moins environ 5 g d'une solution salée à 1 % par g de structure.

2. Procédé selon la revendication 1, caractérisé en ce que l'on applique un vide au tissu pour régler le degré de pénétration du latex dans le tissu.

3. Procédé selon la revendication 1 ou la revendication 2, caractérisé en ce que la formation du tissu fibreux déposé à sec comprend: (1) le dépôt à sec de fibres pour former un premier tissu fibreux; (ii) l'application d'un matériau superabsorbant particulaire sur une surface dudit premier tissu fibreux, et (iii) le dépôt à sec de fibres sur cette surface pour former un second tissu fibreux, ce qui donne un tissu composite contenant un superabsorbant.

4. Procédé selon la revendication 1 ou la revendication 2, caractérisé en ce que la formation du tissu fibreux déposé à sec comprend: (i)) le dépôt à sec de fibres pour former un premier tissu fibreux; (ii) l'application d'un élément renforçant poreux sur une surface dudit premier tissu fibreux, et (iii) le dépôt à sec de fibres sur la surface exposée dudit élément renforçant pour former un second tissu fibreux, ce qui donne un tissu composite, un matériau superabsorbant particulaire étant incorporé dans au moins l'un desdits premier et second tissus fibreux.

5. Procédé selon l'une quelconque des revendications 1 à 4, caractérisé en ce que l'on applique ledit latex sur les deux surfaces dudit tissu.

6. Procédé selon la revendication 1 ou la revendication 2, caractérisé en ce que la formation du tissu fibreux déposé à sec comprend les étapes selon lesquelles: (i) on fournit un élément renforçant poreux, et (ii) on dépose à sec, sur au moins une surface dudit élément renforçant poreux, des fibres pour former un tissu composite fibreux formé par dépôt à sec dans lequel est incorporé un matériau superabsorbant particulaire, et on applique du latex liquide sur la surface dudit tissu composite opposée à l'élément renforçant.

7. Procédé selon la revendication 1 ou la revendication 2, caractérisé en ce que la formation du tissu formé par dépôt à sec comprend le dépôt à l'air de fibres dc cellulose technique pour former un tissu fibreux dans lequel est incorporé au hasard un matériau superabsorbant particulaire, ledit matériau superabsorbant constituant environ 1 à 65 % eu masse de la masse de ladite structure, l'application d'un latex liquide sur les deux surfaces dudit tissu et le durcissement dudit latex pour la formation de ladite structure.

8. Procédé selon la revendication 1 ou la revendication 2, caractérisé en ce qu'il comprend les étapes selon lesquelles: (a) on effectue un dépôt à l'air de fibres comprenant des fibres de cellulose technique pour former un premier tissu fibreux; (b) on applique un élément renforçant poreux sur une surface dudit premier tissu fibreux; (c) on effectue un dépôt à l'air de fibres comprenant des fibres de cellulose technique sur la surface exposée dudit élément renforçant pour former un second tissu fibreux dans lequel sont incorporées au hasard des particules solides d'un matériau superabsorbant, en formant ainsi un tissu composite, ledit matériau superabsorbant constituant environ 1 à 65 % en masse de la masse de ladite structure, et (d) on applique sur les deux surfaces dudit tissu composite un latex liquide et on durcit ledit latex.

9. Procédé selon la revendication 7 ou la revendication 8, caractérisé en ce que les dites fibres de cellulose technique sont mélangées avec une quantité allant jusqu'à 50 % en masse de fibres synthétiques.

10. Procédé selon l'une quelconque des revendications 1 à 9, caractérisé en ce que ledit latex est activé par application de chaleur à une température d'environ 93 à environ 260°C (environ 200 à environ 500°F).

11. Procédé selon l'une quelconque des revendications 1 à 11, caractérisé en ce que ledit tissu est densifié avant l'application dudit latex.

12. Structure absorbant les liquides comprenant des fibres déposées à sec, un matériau superabsorbant et une résine comme liant, caractérisée en ce que ladite structure comprend un tissu fibreux lâche formé par dépôt à sec (46) dans lequel est réparti un matériau superabsorbant particulaire (48), ledit tissu étant stabilisé par un agent liant pour la structure comprenant du latex thermodurcissable (50) qui a pénétré partiellement dans le tissu à partir d'au moins une surface dudit tissu et qui est ensuite durci, ledit latex durci constituant 5 à 30 % en masse, par rapport à la masse de la structure, et ladite structure ayant (i) une masse surfacique d'environ 20 à 500 g/m^2, (ii) une capacité d'absorption d'au moins environ 6 g d'une solution salée à 1 % par g de structure et (iii) une capacité de rétention d'au moins environ 5 g d'une solution salée à 1 % par g de structure.

13. Structure déposée à sec selon la revendication 12, caractérisée en ce qu'un élément renforçant poreux (62) est appliqué sur au moins une surface dudit tissu fibreux.

14. Structure déposée à sec absorbant les liquides selon la revendication 12, caractérisée en ce qu'elle comprend un élément renforçant poreux (62) disposé essentiellement entre les surfaces dudit tissu fibreux, des particules solides d'un matériau superabsorbant étant incorporées au hasard dans ledit tissu fibreux d'un côté dudit tissu renforçant.

15. Structure selon la revendication 13 ou la revendication 14, caractérisée en ce que ledit élément renforçant est choisi parmi du papier crêpé, du papier façonné en 3D et de la mousseline.

16. Structure selon l'une quelconque des revendications 12 à 15, caractérisée en ce que ladite structure comprend environ 10 à 20 % en masse de latex.

17. Structure selon l'une quelconque des revendications 12 à 16, caractérisée en ce que ledit tissu fibreux comprend des fibres cellulosiques, des fibres synthétiques, ou un mélange de fibres cellulosiques et de fibres synthétiques.

18. Structure selon la revendication 17, caractérisée en ce que ledit tissu fibreux comprend environ 65 à 95 % en masse de libres de cellulose technique.

19. Structure selon la revendication 17, caractérisée en ce que ledit tissu fibreux comprend au moins environ 50 % en masse de fibres de cellulose technique.

20. Structure selon la revendication 19, caractérisée en ce que ledit tissu fibreux comprend des fibres de cellulose technique éventuellement mélangées avec jusqu'à environ 50 % en masse de fibres synthétiques.

21. Structure selon l'une quelconque des revendications 12 à 20, caractérisée en ce que l'agent liant comprend un latex thermodurcissable qui a partiellement pénétré dans le tissu à partir des deux surfaces dudit tissu et qui est ensuite durci.

22. Structure selon l'une quelconque des revendications 12 à 21, caractérisée en ce que ledit matériau superabsorbant constitue environ 1 à 65 % en masse de ladite structure.

23. Structure selon la revendication 22, caractérisée en ce que ledit matériau superabsorbant constitue environ 10 à 65 % en masse de ladite structure.

24. Structure selon la revendication 23, caractérisée en ce que ledit matériau superabsorbant constitue environ 35 à 55 % en masse de ladite structure.

25. Structure selon l'une quelconque des revendications 12 à 24, caractérisée en ce que ladite masse surfacique est d'environ 20 à 350 g/m^2, ladite capacité d'absorption est d'au moins environ 8 g/g, et ladite capacité de rétention est d'au moins environ 6 g/g.

26. Couche jetable contenant comme tampon absorbant une structure selon l'une quelconque des revendications 12 à 25 ou obtenue par un procédé selon l'une quelconque des revendications 1 à 11, et contenant environ 10 à 65 % en masse dudit matériau superabsorbant particulaire solide.

27. Serviette hygiénique ayant un élément extérieur perméable aux liquides et un élément opposé imperméable aux liquides et une structure intermédiaire absorbant les liquides, formée par dépôt à sec, selon l'une quelconque des revendications 12 à 25 ou obtenue par un procédé selon l'une quelconque des revendications 1 à 11, et contenant environ 10 à 65 % en masse dudit matériau superabsorbant particulaire solide.

28. Chiffon pouvant être adapté pour absorber des liquides, contenant un tissu fibreux formé par dépôt à sec selon l'une quelconque des revendications 12 à 25 ou obtenu par un procédé selon l'une quelconque des revendications 1 à 11, et contenant environ 10 à 65 % en masse dudit matériau superabsorbant particulaire solide.

29. Tampon pour incontinents comprenant un tissu fibreux formé par dépôt à sec selon l'une quelconque des revendications 12 à 25 ou obtenu par un procédé selon l'une quelconque des revendications 1 à 11.

30. Rouleau constitué d'une pluralité de tampons absorbant les liquides, chacun desdits tampons étant séparable dudit rouleau le long d'une entaille transversale, chaque tampon comprenant un tissu fibreux formé par dépôt à sec selon l'une quelconque des revendications 12 à 25 ou obtenu par un procédé selon l'une quelconque des revendications 1 à 11 et contenant environ 10 à 65 % en masse dudit matériau superabsorbant particulaire solide.

Fig.1

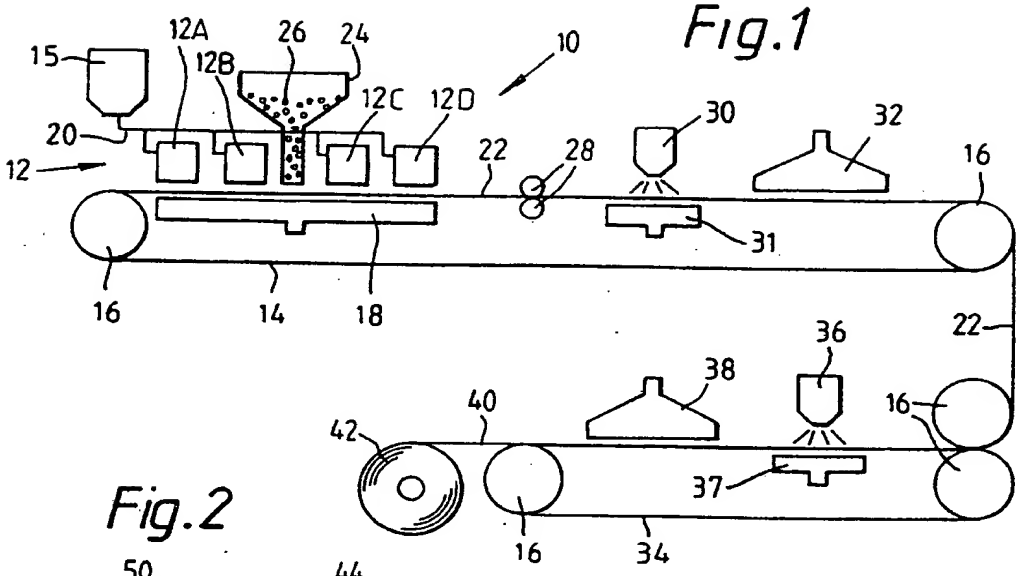

Fig.2

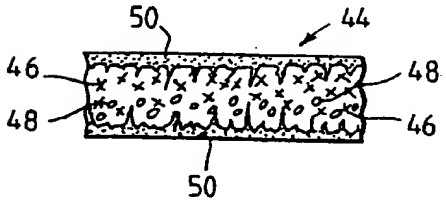

Fig.5

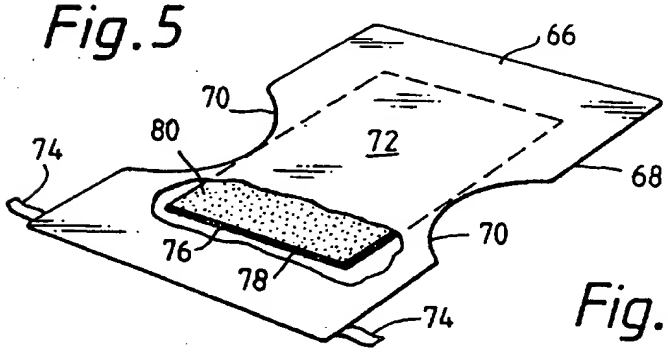

Fig.6

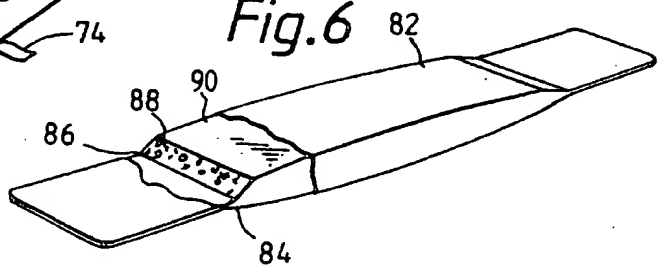

Fig. 3A

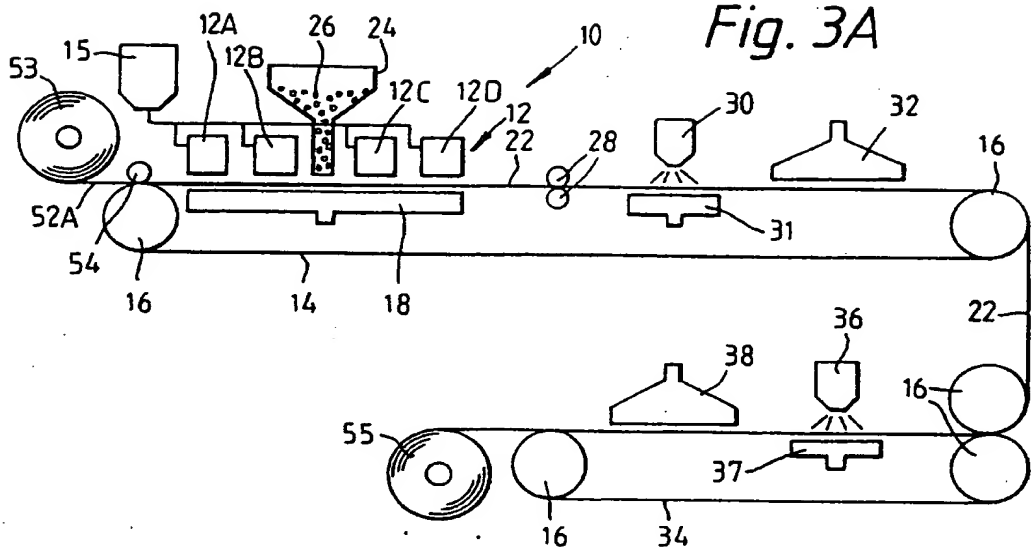

Fig.3B

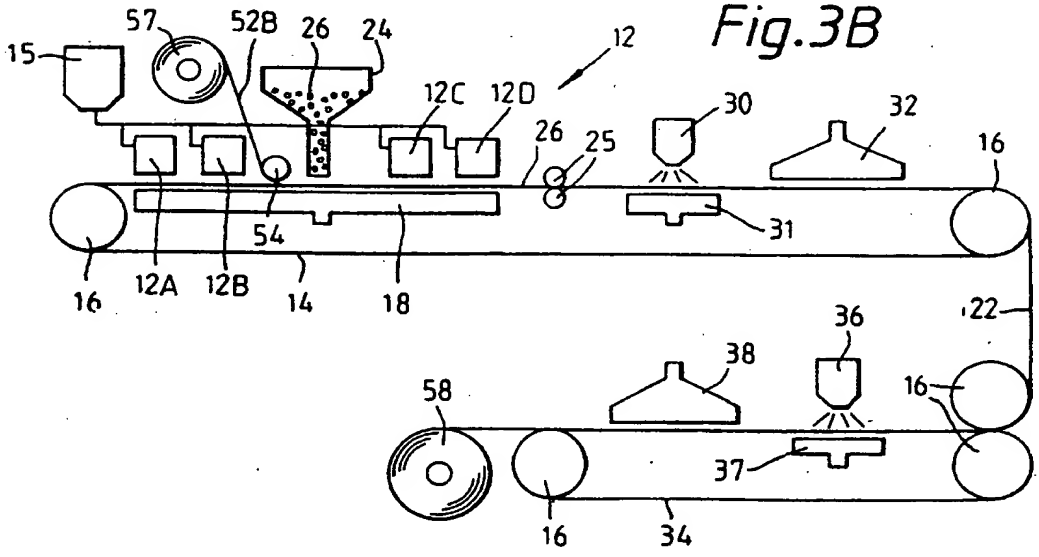

Fig 4A

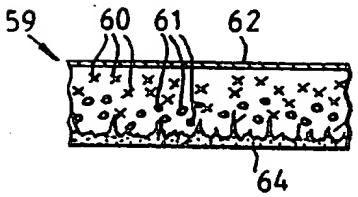

Fig.4B

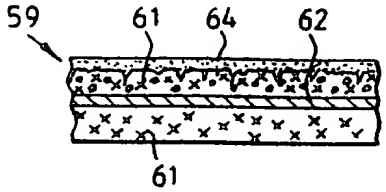

Fig 7

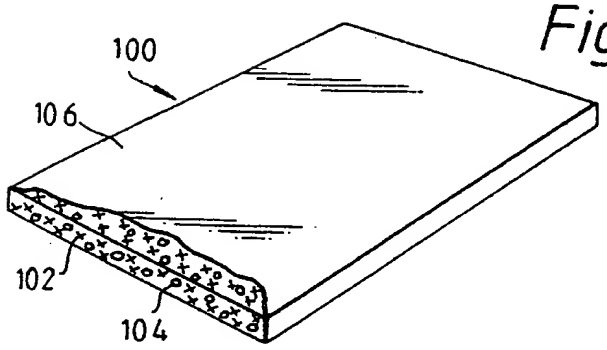

Fig 8

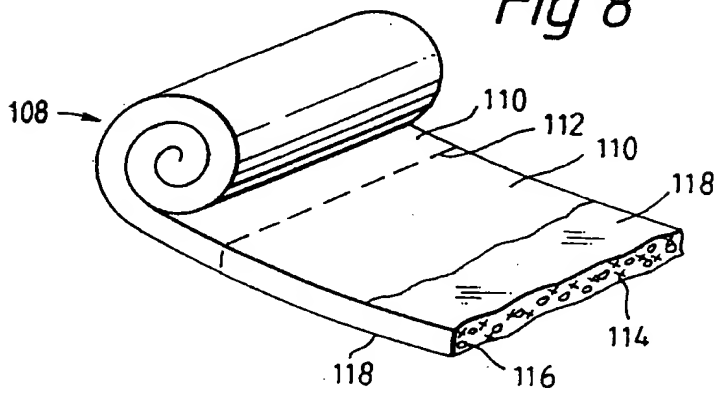

Fig.9

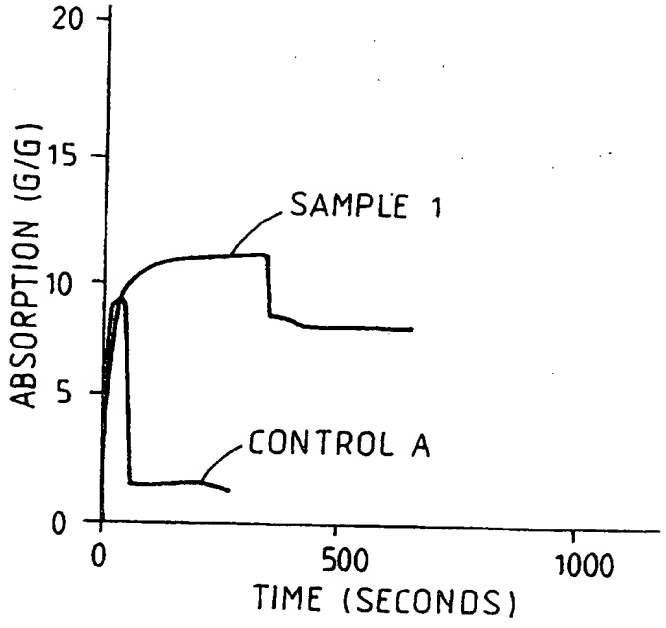

Fig.10

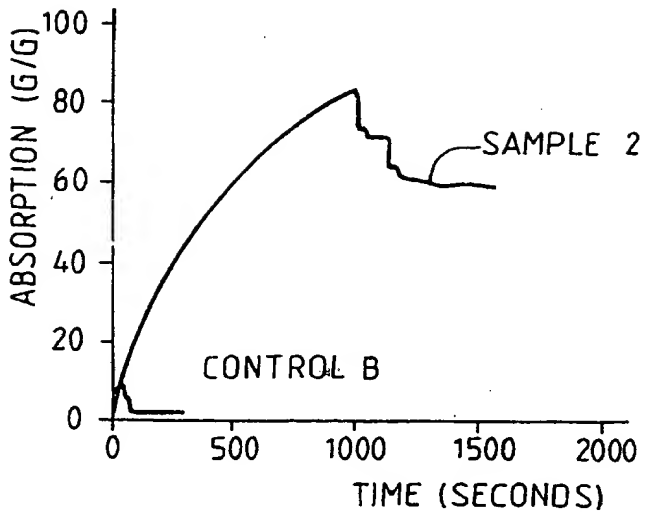

Fig.11

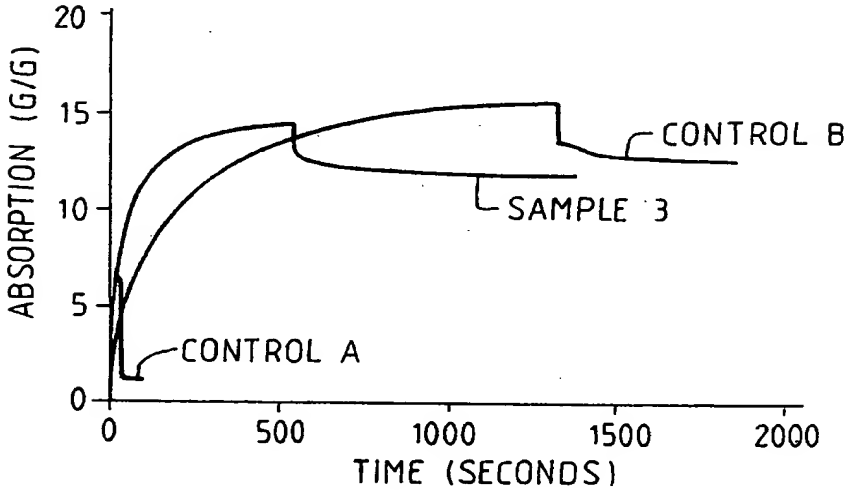

Fig.12